

REMARKS/ARGUMENTS

Claims 1, 4-7, 10-14, 20, and 21 are pending.

The applicants' attorney would like to thank the Examiner for his time during the telephone interview of May 19, 2004. The 35 U.S.C. 112 rejection and 35 U.S.C. 103 rejection were discussed, as discussed below.

The Examiner rejected claims 1, 4-7, 10-14, and 20-21 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Regarding claims 1 and 7, the Examiner stated that there is no indication in the specification that the layer of organosilicate glass dielectric is over an etch stop layer of any sort. Page 8, line 28-29, states that layer 16 is a trench or etch stop layer, which is shown in Fig. 2a-e. Etch stop layer 16 is shown to be below layer 14, which page 8, line 19, states is an organosilicate dielectric layer. Therefore, the application supports having an organosilicate glass dielectric layer 14 over an etch stop layer 16. In addition, page 8, lines 13-20, support having a highly selective etch between the organosilicate glass dielectric layer 14 and the etch stop layer 16. For at least these reasons, claims 1, 4-7, 10-14, and 20-21 do not fail to comply with the written description requirement.

The Examiner rejected claims 1-7, and 10-13 under 35 U.S.C. 103(a) as being unpatentable over Hung et al. (US 6,387,287 B1) as applied to claim 1-5, 7-10 above, and further in view of Chang et al. (US 5,739,579) and Wolf et al. (Volume 1, pp. 556). The applicant did not see how Hung is applied to claim 1-5, 7-10 above and requests clarification.

Although Hung may teach etching through an organosilicate glass by teaching etching through a TEOS oxide ARC using a C₄F₈, CF₄ and Ar etchant, Hung does not disclose or make obvious selectively etching a feature in an organosilicate glass layer using an etchant gas mixture of C₄F₈, CH₂F₂, oxygen, and CF₄, as recited in claims 1 and 7.

Although col. 17, lines 20-35, of Hung teaches that CH₂F₂ and O₂ are useful for providing greater nitride selectivity, this improved nitride selectivity is for the Main Etch, where the main etch etches a BPSG not the ARC open, where the ARC layer is a TEOS layer. BPSG of the main etch and TEOS, which the Examiner argues is OSG, have different etch properties, as shown in Table 10 of Hung, where different etch chemistries are used for the different materials. This is shown by Table 10, in that different etchants are

required for etching TEOS than other oxides such as BPSG. Since BPSG and TEOS have different etch chemistries, one cannot conclude that an etch chemistry useful in etching BPSG would also be useful in etching TEOS. Nothing in Hung discloses or suggests adding CH₂F₂ and O₂ to an etch chemistry for OSG. **Nothing in Hung et al. suggests that the addition of CH₂F₂ and oxygen of the etch chemistry for TEOS, would provide a greater organosilicate glass to nitride selectivity, which is the motivation cited by the Examiner. In addition, Hung in Table 10 teaches away from providing O₂ for the TEOS etch.** Table 10, specifically shows that O₂ is used in the main etch but is not added to an etch for the TEOS.

In the third paragraph of part 4 of the Office Action, the Examiner agrees that Hung does not explicitly disclose the use of CH₂F₄ and O₂ as components of the organic oxide etchant gas containing C₄F₈, CF₄, and Ar. Neither Chang nor Wolf remedies this deficiency. Col. 14, line 65, to col. 15, lines 33, of Chiang cited by the Examiner discusses etching BCB and therefore does not make obvious the inventive chemistry for selectively etching OSG over an etch stop. The applicant agrees that page 556 of Wolf teaches the etching of silicon nitride with a CF₄, O₂ plasma. However, neither reference remedies the deficiencies of Hung, especially regarding selectively etching an OSG layer over an etch stop using a chemistry of C₄F₈, CH₂F₂, oxygen, and CF₄.

The Examiner stated that would have been obvious to one of ordinary skill in the art at the time of the present invention to modify the Hung reference and that Hung suggests the addition of CH₂F₂ and O₂ to plasma etching gases for greater nitride selectivity. As mentioned before, col. 17, lines 18-35, of Hung teaches that CH₂F₂ with the addition of O₂ improves main etch selectivity for BPSG not for TEOS. In addition, as mentioned before, the Examiner agreed in the office action that Hung does not explicitly disclose the use of CH₂F₂ as a component of the organic oxide etchant gas containing C₄F₈, CF₄, and Ar.

In addition, claim 7 recites that the etch stop layer is a silicon carbide etch stop layer. Nothing in the cited references suggest selectively etching OSG with respect to a silicon carbide etch stop layer. Since the etch stop is silicon carbide, the improvement of nitride corner selectivity is not desired.

For at least these reasons, claims 1 and 7 are not anticipated or made obvious by Hung in view of Chiang and Wolf.

The Examiner rejected claims 14, 20, and 21 under 35 U.S.C. 103(a) as being unpatentable over Hung, Chiang, and Wolf as applied to claims 1-13 above and further in view of Li et al. (US 6,284,149).

Claims 2-6, 10-14, 20, and 21 are ultimately dependent on claims 1 and 7, and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to claims 1 and 7. Additionally, these dependent claims require additional elements that, when taken in the context of the claimed invention, further patentably distinguish the art of record.

For example, claim 11 further recites the stopping the flow of C₄F₈ and CH₂F₂ to selectively etch through the silicon carbide etch stop. Although Wolfe et al. does disclose that a plasma etchant of CF₄ and O₂ may be used to etch Si₃N₄, Wolfe et al. does not suggest or make obvious that such a plasma etchant would successfully etch silicon carbide.

In addition, claim 13 further recites etching through a second OSG layer, which is not disclosed or made obvious by the references.

In addition, claims 14, 20, and 21 further recite stripping a photoresist mask that is above a layer of organosilicate glass and that the photoresist mask is used to pattern the layer of organosilicate glass where the stripping is done by stopping the flow of certain etch component gases. Li teaches a stripping process that is used for the main etch, since the step of Li etches and strips at the same time. In addition, col. 18, lines 64-65, of Li teaches that the chemistry of second step is to mainly etch remaining BCB or a small amount of photoresist. Therefore, Li, teaches stripping the photoresist with the chemistry of the first step. Therefore, Li does not teach or suggest a stripping done after the main etch with the recited chemistry. In addition, none of the cited references teach that the chemistry recited in claims 14, 20, and 21 would successfully selectively remove photoresist from OSG. If such an etch chemistry would mainly etch BCB and strip some photoresist, such an etch may also mainly etch OSG, which is not desirable.

The Examiner stated in the last paragraph of the "Response to Arguments" that the splitting of one step into two where the processes are substantially identical in terms of function, manner, and result was held to not patentably distinguish the process. The single step process of stripping and etching of Li is substantially different then the separate steps of etching and then stripping, as recited in claims 14, 20, and 21. Li uses a single step with a single etch chemistry to both strip and etch. Claims 14, 20, and 21 recite using different gases to separately etch the OSG

and then strip the photoresist. In the application of Li to Hung, the recipe of Li used to etch the TEOS ARC layer of Hung would also strip the photoresist mask during the TEOS ARC opening. As a result, there would be not a photoresist mask for the main etch. For at least these reasons, claims 2-6, 10-14, 20, and 21 are not made obvious by the cited references.

In view of the above, it is respectfully submitted that the application is in a condition for allowance and action to that effect is respectfully requested at an early date. If the Examiner feels that a telephone conference would expedite allowance of this application, the Examiner is invited to call the undersigned at (831) 655-2300.

The Commissioner is authorized to charge any fees that may be due to our Deposit Account No. 50-0388 (Order No. LAM1P154).

Respectfully submitted,
BEYER WEAVER & THOMAS, LLP

A handwritten signature in black ink, appearing to read "Michael Lee", with a stylized flourish at the end.

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